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EXAMINER

UMEZ ERONINI, LYNETTE T

ART UNIT PAPER NUMBER

1765

DATE MAILED: 10/10/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/715,690

Applicant(s)

MILLER, ANNE E.

Examiner

Lynette T. Umez-Eronini

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-- The MAILING DATE of this communication appears on the cover sheet with the corresponding address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on 29 July 2003.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-30 is/are pending in the application.
- 4a) Of the above claim(s) 17-30 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,3-7,9 and 11-16 is/are rejected.
- 7) ☒ Claim(s) 2, 8 and 10 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s) _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1, 3, 4, 6, 7, and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kaufman et al. (US 5,954,997) in view of Feller et al. (US 5,700,383) and further in view of Grumbine et al. (US 6,083,419).

As pertaining to claims 1, 4, and 7, Kaufman teaches a slurry comprising a mixture (column 5, lines 1-5) of:

a surfactant (column 4, line 54 and column 6, lines 36-41);

an abrasive such as silica (column 7, lines 1-5);

an oxidizer such as hydrogen peroxide (column 4, line 52); and

a corrosion inhibitor such as benzotriazole (column 4, line 54), wherein the slurry has a pH in the range of 2.0 to 12.0 (column 8, lines 22-25), which encompasses the slurry that has a pH between 2.5 and 7.0.

Kaufman differs in failing to teach a chelating buffer system, **in claims 1 and 6.**

Feller teaches citric acid (chelate) and potassium citrate buffer (same as applicant's chelating buffer system), which has a concentration that is high

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enough to maintain a pH, but low enough to ensure solubility and keep cost down (column 5, lines 19-20 and 41-44).

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Kaufman by employing a buffer system as taught by Feller for the purpose of using a buffer that maintains the pH of the slurry (column 5, lines 41-44).

Kaufman in view of Feller differs in failing to teach a surfactant containing an alkyltrimethylammonium cation, **in claim 1**; cetyltrimethylammonium cation **in claim 3**; and wherein the surfactant comprising cetyltrimethylammonium hydroxide **in claim 9**.

Grumbine teaches a cmp slurry comprising corrosion inhibitors that produce alkyl ammonium ions in aqueous solutions upon dissolution, that include cetyltrimethylammonium (wherein the cetyltrimethylammonium is the same as applicant's alkyltrimethylammonium cation and cetyltrimethylammonium cation) hydroxide, tricaprilmethylammonium chloride, and tetramethylammonium hydroxide and mixture thereof, and that range from 0.001 to about 2.0 weight percent (column 4, lines 6-10 and column 5, lines 16-26 and 27-30).

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Kaufman in view of Feller by using Grumbine's cetyltrimethylammonium hydroxide for the purpose of polishing a substrate at very high rates to give a polished substrate that is capable of accepting a subsequent layer of metallization without filling, or

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contact problems caused by unacceptable recessing or keyholing (Grumbine, column 3, lines 1-6).

3. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kaufman ('997) in view of Feller ('383) and Grumbine ('419), as applied to claim 1 above, and further in view of Neville et al. (US 5,527,423).

Kaufman in view of Feller and Grumbine differs in failing to teach the chelating buffer system comprises ammonium bicitrate and potassium dissolved in the mixture.

Neville teaches oxidizing components such as citrates, potassium salts, ammonium salts, quaternary ammonium salts, and mixtures thereof may be added to a polishing slurry and the amount of the oxidizing component is sufficient to balance the mechanical and chemical (colloidal stability) polishing components of the slurry (column 5, lines 8-27).

It is the examiner's position that adding Neville's oxidizing components of citrates, potassium salts and ammonium salts to a polishing solution would produce the same components as applicant's chelating buffer system, hence, it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Kaufman in view of Feller and Grumbine by combining Neville's oxidizing components for the purpose of polishing a metal while minimizing surface imperfections (see Neville, column 6, lines 52-56).

4. Claims 11, 13, 14, and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kaufman et al. (US 5,954,997) in view of Feller et al. (US 5,700,383) and further in view of Grumbine et al. (US 6,083,419).

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As pertaining to claims 11, 13, and 16, Kaufman teaches a slurry comprising a mixture (column 5, lines 1-5) of:

a surfactant (column 4, line 54 and column 6, lines 36-41);

an abrasive such as silica (column 7, lines 1-5);

an oxidizer such as hydrogen peroxide (column 4, line 52); and

a corrosion inhibitor such as benzotriazole (column 4, line 54), wherein the slurry has a pH in the range of 2.0 to 12.0 (column 8, lines 22-25), which encompasses the slurry that has a pH between 2.5 and 7.0.

Kaufman differs in failing to teach a chelating buffer system, **in claims 11 and 16**.

Feller teaches citric acid (chelate) and potassium citrate buffer (same as applicant's chelating buffer system), which has a concentration that is high enough to maintain a pH, but low enough to ensure solubility and keep cost down (column 5, lines 19-20 and 41-44).

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Kaufman by employing a buffer system as taught by Feller for the purpose of using a buffer that maintains the pH of a slurry (Feller, column 5, lines 41-44).

Kaufman in view of Feller differs in failing to teach a surfactant containing an alkyltrimethylammonium cation, **in claim 11**; and comprising cetyltrimethylammonium hydroxide **in claim 14**.

Grumbine teaches a cmp slurry comprising corrosion inhibitors that produce alkyl ammonium ions in aqueous solutions upon dissolution, that include

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cetyltrimethylammonium hydroxide (wherein cetyltrimethylammonium is the same as applicant's cetyltrimethylammonium cation) . . . and mixture thereof, and that range from 0.001 to about 2.0 weight percent (column 4, lines 6-10 and column 5, lines 16-26 and 27-30).

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Kaufman in view of Feller by using Grumbine's cetyltrimethylammonium hydroxide for the purpose of polishing a substrate at very high rates to give a polished substrate that is capable of accepting a subsequent layer of metallization without filling, or contact problems caused by unacceptable recessing or keyholing (Grumbine, column 3, lines 1-6).

5. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kaufman ('997) in view of Feller ('383) and Grumbine ('419), as applied to claim 11 above, and further in view of Kato et al. (US 5,904,159).

Kaufman in view of Feller and Grumbine differs in failing to teach an abrasive comprises silica abrasive having a surface area of 500 m²/g.

Kato teaches an abrasive comprises silica that has a surface area of 500 m²/g and an average particle size from 55 to 5 nm, which is in a range that is necessary for obtaining good preservation stability and preventing the polished surfaces from being scarred (column 4, lines 24-36)

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Kaufman in view of Feller and Grumbine by using the abrasive as taught by Kato for the

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purpose of preventing the polished surfaces from being scarred (Kato, column 4, lines 34-35).

6. Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kaufman ('997) in view of Feller ('383) and Grumbine ('419) as applied to claim 11 above, and further in view of Tsai et al (US 5,575,706).

Kaufman in view Feller and Grumbine differ in failing to teach a slurry having a density of 1.03 g/ml.

Tsai teaches parameters that affect the polishing rate include slurry particle density and the adjustment of this parameter permits control of the polishing and planarization processes (column 1, lines 61-66), which suggests that the density is a variable parameter.

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Kaufman in view Feller and Grumbine by varying the density of the slurry as taught by Tsai for the purpose of improving the performance of the polishing process (Tsai, column 1, lines 65-66).

Allowable Subject Matter

7. Claims 2, 8, and 10 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

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8. The following is a statement of reasons for the indication of allowable subject matter: Prior art fails to disclose a polishing slurry that comprises cetyltrimethylammonium bromide.

Response to Arguments

9. Applicant's arguments filed 6/17/2003 have been fully considered but they are not persuasive. Applicant argue the declaration signed by the Applicant to support, Grumbine's corrosion inhibitors, which are used in a chemical mechanical polishing slurry for tungsten would not be used in a copper polishing slurry because of copper and tungsten differ in oxidation and corrosion properties. Applicant's argument is unpersuasive because the declaration has failed to show the effect of Grumbine's corrosion inhibitors on copper. Applicant also argue the decrease in the patterned erosion rate of a dielectric layer that is shown in Exhibit A of the declaration show advantages that are unexpected by the references. Applicant's argument is unpersuasive because the results of Exhibit A fail to show and compare the patterned erosion rate of a dielectric layer by using Grumbine's alkyltrimethylammonium cation surfactant.

Applicant traverses the rejection of claims 1-16 and argues the combination of Grumbine's corrosion inhibitors with Kaufman's and Feller's slurry would not be obvious because copper and tungsten differ in oxidation and corrosion properties. Applicant's argument is unpersuasive because Grumbine is relied upon to teach a cetyltrimethylammonium cation, which Kaufman and Feller lack. Combining Grumbine's cetyltrimethylammonium cation (same as

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applicant's cetyltrimethylammonium hydroxide) with the slurry of Kaufman and Feller would be obvious for the purpose of polishing a substrate at very high rates to give a polished substrate that is capable of accepting a subsequent layer of metallization without filling, or contact problems caused by unacceptable recessing or keyholing (Grumbine, column 3, lines 1-6).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lynette T. Umez-Eronini whose telephone number is 703-306-9074. The examiner is normally unavailable on the First Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 703-305-2667. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Lynette T. Umez-Eronini

ltue

October 9, 2003